

RefSet Viva

Automatic Reference Line and Stakeout Program for Leica Viva TS15

User Manual

Version 2.7

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1. RefSet Program

RefSet Viva Installation on TPS

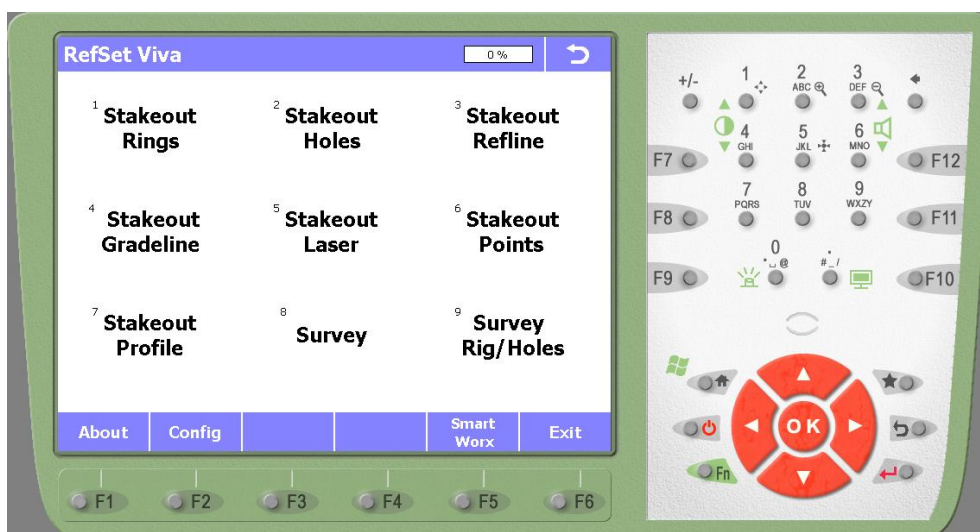
- Copy **Install_RefSet_Viva_{version}.cab** to the memory card
- Insert the card into the TPS
- Minimise or exit from the Leica SmartWorx program by pressing **Fn** then **F5** (Minim) or **F6** (Exit) at the start screen
- Using Windows Explorer navigate to the **Install_RefSet_Viva_{version}.cab** file on the memory card and double tap it
- Tap on **OK** to *Install RefSet Viva*
- RefSet Viva will then be installed onto the TPS
- A shortcut to the program will be placed in the *Start* menu and on the desktop

RefSet Viva Key File Installation

- Copy the **RefSet_v2_{serial number}.key** file to the memory card
- Insert the card into the TPS
- Using Windows Explorer copy the **RefSet_v2_{serial number}.key** file to the **Program Files\RefSet_Viva** folder on the TPS

Starting RefSet Viva

- To start RefSet Viva first minimise or exit from the Leica SmartWorx program by pressing **Fn** then **F5** (Minim) or **F6** (Exit) at the start screen
- Double tap the RefSet Viva shortcut on the windows desktop



RefSet Viva - Main Menu

RefSet Program Configuration

- *Data File Type* Set to the type of control job files to use in RefSet:

STR	Surpac string file
GSI	Leica gsi data file
DXF	Autocad dxf file

- *Data Folder* Set to the location of the control job files:

SD Card	SD memory card
USB Stick	USB memory stick
Internal	Internal folder on the TPS (Leica Geosystems\SmartWorx Viva)

The control job files need to be saved in the following subfolders of the *Data Folder*:

STR	'Data' subfolder
GSI	'Gsi' subfolder
DXF	'Data' subfolder

- *Use Common Data File* Set to **Yes** to use a common data file name for every function

The Control Job name chosen in one function (eg: Stakeout Rings) will also be set in the other functions (eg: Stakeout Holes, Stakeout Refline, etc). Otherwise each function will 'remember' the Job name chosen previously in that function

- *Log Staked Points* Set to **Yes** to save the automatic stakeout points to a log file

The points staked in all automatic modes will be saved to a file with the same name as the control job with '*_log*' added which will be saved in a subfolder named '*Log*' under the current *Data Folder*

- *Log File Type* Set to the type of log file to save the automatic stakeout point data to:

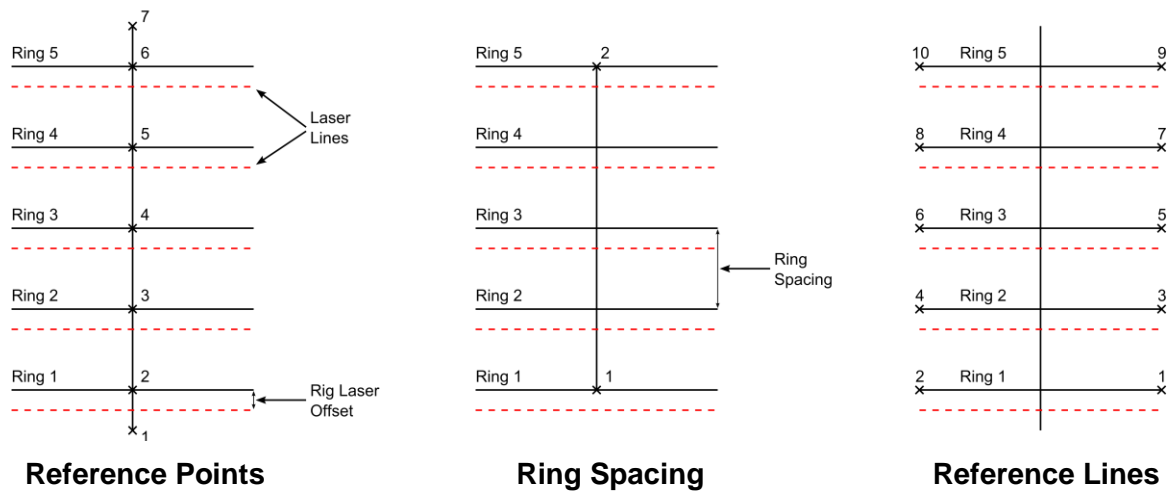
STR	Surpac string file
GSI	Leica gsi data file
CSV	Comma separated text file

- *Grade Display* Sets the input and output format for grades:

H:V	Horizontal by vertical distance
V:H	Vertical by horizontal distance
%(V/Hx100)	Percentage of vertical by horizontal distance

2. Stakeout Rings

Ring Definition Methods



There are three methods for defining rings in RefSet:

- Reference Points** Has two points to define the reference line (eg: 1 & 7) and a point located on each ring (eg: 2 to 6) which need to be numbered in consecutive order to enable RefSet to increment to the next ring in auto stakeout mode
- Ring Spacing** Has two points to define the reference line (eg: 1 & 2) with one of those points located on the first ring and a spacing between the rings
- Reference Lines** Has two points on each ring (eg: Ring1: 1 & 2, Ring2: 3 & 4, etc) which need to be numbered in consecutive order to enable RefSet to increment to the next ring in auto stakeout mode

There are two offset values that can be pre-set for the ring stakeout:

- Rig Laser Offset** This sets the distance from the laser position to the drill rod position on the particular drill rig used to drill the rings. A positive value will move the *Laser Lines* in the direction of the reference line for the **Reference Points** and **Ring Spacing** methods and to the right of the ring for the **Reference Lines** method
- Auto Height Offset** This sets the *Height* offset of the points that will be staked out in the auto stakeout mode. If this setting is not used then the *Height* value of the first point measured when the auto stakeout is started will be used to set the stakeout *Height* offset

Note: These two settings can be enabled or disabled in the Stakeout Rings Configuration

Stakeout Rings Procedure

1. Tap or select **Stakeout Rings** on the start menu screen
2. Select the *Control Job* to use from the list and press **F1** (OK)

3. Stakeout Rings by Reference Lines

Stakeout Rings - Control Job	Stake Rings By Ref Lines - Setup	Stake Rings By Ref Lines
Control Job: <input type="text" value="refset_test"/>	First Point On Ring: <input type="text" value="1"/>	Auto Stake Pattern: <input type="text" value="LRLR...."/>
	Second Point On Ring: <input type="text" value="2"/>	Ring Reference Line: 1 - 2
	Rig Laser Offset: <input type="text" value="1.000"/>	Auto Stakeout Side: Left
	Auto Height Offset: <input type="text" value="1.500"/>	Offset from Laser Line: -1.079
		Height from Ring: 1.598

OK	Config	Create New Job	OK	Config	Enter New Point	Measure New Point	Map	Dist	Start Auto	Previous Ring	Next Ring	New Ring
----	--------	----------------	----	--------	-----------------	-------------------	-----	------	------------	---------------	-----------	----------

- 3.1. Select the *First Point* and *Second Point* of the ring to be staked out from the lists
- 3.2. If the *Use Rig Laser Offset* and/or *Use Set Height Offset For Auto Stakeout* settings have been set in the Configuration then enter these values and press **F1** (OK)

3. Stakeout Rings by Reference Points

Stakeout Rings - Control Job	Stake Rings By Ref Points - Setup	Stake Rings By Ref Points
Control Job: <input type="text" value="refset_test"/>	Start Point of Ref Line: <input type="text" value="1"/>	Auto Stake Pattern: <input type="text" value="LRLR...."/>
	End Point of Ref Line: <input type="text" value="12"/>	Reference Line: 1 - 12
	Ring Reference Point: <input type="text" value="1"/>	Ring Reference Point: 1
	Rig Laser Offset: <input type="text" value="1.000"/>	Auto Stakeout Side: Left
	Auto Height Offset: <input type="text" value="1.500"/>	Offset from Laser Line: -0.927
		Height from Ring: 1.590

OK	Config	Create New Job	OK	Config	Enter New Point	Measure New Point	Map	Dist	Start Auto	Previous Ring	Next Ring	New Ring
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- 3.1. Select the *Start Point* and *End Point* of the reference line used to define the rings from the lists
- 3.2. Select the *Ring Reference Point* of the ring to be staked out from the list
- 3.3. If the *Use Rig Laser Offset* and/or *Use Set Height Offset For Auto Stakeout* settings have been set in the Configuration then enter these values and press **F1** (OK)

3. Stakeout Rings by Ring Spacing

Stakeout Rings - Control Job	Stake Rings By Ring Spacing - Setup	Stake Rings By Ring Spacing
Control Job: <input type="text" value="refset_test"/>	Start Point of Ref Line: <input type="text" value="1"/>	Auto Stake Pattern: <input type="text" value="LRLR...."/>
	End Point of Ref Line: <input type="text" value="12"/>	Reference Line: 1 - 12
	Ring Spacing: <input type="text" value="1.000"/>	Ring Number: 1
	Ring Number: <input type="text" value="1"/>	Auto Stakeout Side: Left
	Rig Laser Offset: <input type="text" value="1.000"/>	Offset from Laser Line: -0.927
	Auto Height Offset: <input type="text" value="1.500"/>	Height from Ring: 1.590

OK	Config	Create New Job	OK	Config	Enter New Point	Measure New Point	Map	Dist	Start Auto	Previous Ring	Next Ring	New Ring
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- 3.1. Select the *Start Point* and *End Point* of the reference line used to define the rings from the lists
- 3.2. Enter the *Ring Spacing* of the rings
- 3.3. The *Ring Numbers* will then be generated from the reference line points and the ring spacing – ring number one will be located at the *Start Point* of the reference line
- 3.4. Select the *Ring Number* of the ring to be staked out from the list
- 3.5. If the *Use Rig Laser Offset* and/or *Use Set Height Offset For Auto Stakeout* settings have been set in the Configuration then enter these values and press **F1** (OK)

All Stakeout Rings Methods

4. Choose the *Auto Stake Pattern* to use:

LRLR.... Will stakeout the left wall, right wall, left wall, etc
LRRL.... Will stakeout the left wall, right wall, right wall, left wall, etc
One Side Will stakeout the wall on which the auto stakeout is started

5. Point the TPS towards the first ring on the wall to be staked

For the **LRLR....** and **LRRL....** patterns the auto stakeout needs to always be started with the TPS pointing towards the left wall - that is standing behind the instrument facing the first ring to be staked out then the left wall is the one to the left

For all patterns the auto stakeout needs to be started at a point on the wall that is as near to the first ring position as is possible

6. Press **F3** (Start Auto) to start the auto stakeout

Stakeout Rings Configuration

- *Start Dist Measure* Set to **Yes** to start distance measuring when the function starts
- *Auto Offset Accuracy* Sets the accuracy at which the *Offset* value is staked out in auto stakeout mode
(eg: if set to 0.025 the TPS will stake the rings/laser lines *Offset* value to within $\pm 25\text{mm}$ before moving to the next ring)
- *Auto Height Accuracy* Sets the accuracy at which the *Height* value is staked out in auto stakeout mode
(eg: if set to 0.200 the TPS will stake the rings/laser lines *Height* value to within $\pm 200\text{mm}$ before moving to the next ring)
- *Auto Wait Time (secs)* Sets the time the TPS will stop on an auto stakeout point when it has been successfully staked out
(eg: if set to 5 the TPS will wait 5 seconds after it stakes out a point before it moves on to the next ring)
- *Maximum Auto Search Time (secs)*
Sets the maximum time the TPS will search for an auto stakeout point. If set to zero the search time is infinite
(eg: if set to 30 the TPS will search for 30 seconds and if the point is not found it moves on to the next ring)
- *Ring Stakeout Method* Sets the method for defining the rings (see the Ring Definition Methods above):
Reference Lines
Reference Points
Ring Spacing
- *Use Rig Laser Offset* Set to **Yes** to enable a *Rig Laser Offset* to be set and applied to the ring positions
- *Use Set Height Offset For Auto Stakeout*
Set to **Yes** to enable the *Height* offset of the rings/laser lines staked in auto mode to be staked at a set value, set to **No** to stake the rings/laser lines at the *Height* offset of the first point measured when the auto stakeout is started

3. Stakeout Holes

Blast holes are defined by two points on each hole, the hole design collar and the hole design toe. (eg: Hole1: 1 & 2, Hole2: 3 & 4, etc) These points need to be numbered in consecutive order to enable RefSet to increment to the next hole in auto stakeout mode

Stakeout Holes Procedure

Stakeout Holes - Control Job		Stakeout Holes - Point Selection		Stakeout Holes	
Control Job:	refset_test	Hole Collar Point:	1	Hole Reference:	1 - 2
		Hole Toe Point:	2	Slope Line from Collar:	0.342
				Offset from Hole:	0.060
				Perp Height from Hole:	-0.129

OK	Config	Create New Job	OK	Config	Hole Info	Enter New Point	Measure New Point	Map	Dist	Start Auto	Previous Hole	Next Hole	New Hole
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1. Tap or select **Stakeout Holes** on the start menu screen
2. Select the *Control Job* to use from the list and press **F1** (OK)
3. Select the *Hole Collar Point* and *Hole Toe Point* of the hole to be staked out from the lists and press **F1** (OK)
4. Point the TPS towards the wall near to the first hole to be staked
5. Press **F3** (Start Auto) to start the auto stakeout

Missed Holes Procedure

If any holes are missed during the auto stakeout due to the *Maximum Auto Search Time* being exceeded then when the auto stakeout is stopped or finished a message will be shown asking to stake the missed holes manually

1. Tap or select **Yes** or **No** to stake the holes manually
2. If **Yes** the collar and toe points for the first missed hole will be loaded and the hole can then be staked by manually pointing the telescope
3. Press **F5** (Next Hole) or **F4** (Previous Hole) to cycle through the missed holes
4. Press **F6** (New Hole) to finish the missed hole stakeout and resume normal operation

Stakeout Holes Configuration

- *Start Dist Measure* Set to **Yes** to start distance measuring when the function starts
- *Auto Position Accuracy* Sets the accuracy at which the *Offset* and *Perp Height* values are staked out in auto stakeout mode
(eg: if set to 0.025 the TPS will stake the holes *Offset* and *Perp Height* values to within $\pm 25\text{mm}$ before moving to the next hole)
- *Auto Wait Time (secs)* Sets the time the TPS will stop on an auto stakeout point when it has been successfully staked out
(eg: if set to 5 the TPS will wait 5 seconds after it stakes out a point before it moves on to the next hole)
- *Maximum Auto Search Time (secs)*
Sets the maximum time the TPS will search for an auto stakeout point. If set to zero the search time is infinite
(eg: if set to 30 the TPS will search for 30 seconds and if the point is not found it moves on to the next hole)

4. Stakeout Refline

Reference Lines (centrelines) are defined by two points, these points need to be numbered in consecutive order to enable RefSet to increment to the next refline in auto stakeout mode (eg: First Refline: 1 & 2, Second Refline 2 & 3, etc)

Stakeout Refline Procedure

Stakeout Refline - Control Job		Stakeout Refline - Point Selection		Stakeout Refline	
Control Job:	refset_test	Start Point of Refline:	1	Auto Stake Interval:	1.000
		End Point of Refline:	2	Auto Stake Offset:	0.000
				At End of Refline:	Continue
				Refline Reference:	1 - 2
				Hz Line from Start Pt:	0.075
				Offset from Refline:	-0.079
				Height from Refline:	1.599

OK	Config	Create New Job	OK	Config	Refline Info	Enter New Point	Measure New Point	Map	Dist	Start Auto	Previous Refline	Next Refline	New Refline
----	--------	----------------	----	--------	--------------	-----------------	-------------------	-----	------	------------	------------------	--------------	-------------

1. Tap or select **Stakeout Refline** on the start menu screen
2. Select the *Control Job* to use from the list and press **F1** (OK)
3. Select the *Start Point* and *End Point* of the reference line (centreline) to be staked out from the lists and press **F1** (OK)
4. Check the *Auto Stake Interval* value – this is the slope distance between the points staked in auto stakeout mode
5. Check the *Auto Stake Offset* value – this is the *Offset* that will be staked in auto stakeout mode (eg: for a centreline it will be zero)
6. Check the *At End of Refline* setting – this defines the behaviour of the program when the end of the current reference line is reached in auto stakeout mode

Continue The auto stakeout will continue on the same line past the end of the current reference line

Stop The auto stakeout will stop at the end of the current reference line

Next Refline The auto stakeout will increment to the next reference line at the end of the current reference line (eg: First Refline: 1 & 2, Next Refline 2 & 3, etc)

7. Point the TPS towards the wall or backs near to the reference line at a position near where you want to start the stakeout
8. Press **F3** (Start Auto) to start the auto stakeout

Stakeout Refline Configuration

- *Start Dist Measure* Set to **Yes** to start distance measuring when the function starts
- *Auto Offset Accuracy* Sets the accuracy at which the *Offset* value is staked out in auto stakeout mode
(eg: if set to 0.025 the TPS will stake the reference line *Offset* value to within $\pm 25\text{mm}$ of the *Auto Stake Offset* value before moving to the next point on the refline)
- *Auto Interval Accuracy* Sets the accuracy at which the slope distance interval between the points is staked out in auto stakeout mode
(eg: if set to 0.200 the TPS will stake the points on the reference line to within $\pm 200\text{mm}$ of the *Auto Stake Interval* setting from the previous point before moving to the next point)
- *Auto Wait Time (secs)* Sets the time the TPS will stop on an auto stakeout point when it has been successfully staked out
(eg: if set to 5 the TPS will wait 5 seconds after it stakes out a point before it moves on to the next point)
- *Maximum Auto Search Time (secs)*
Sets the maximum time the TPS will search for an auto stakeout point. If set to zero the search time is infinite
(eg: if set to 30 the TPS will search for 30 seconds and if the point is not found it moves on to the next point)

5. Stakeout Gradeline

There are three methods for defining grade lines in RefSet:

- a) Line Uses two design points from the *Control Job*, these points need to be numbered in consecutive order to enable RefSet to increment to the next grade line in auto stakeout mode (eg: First Gradeline: 1 & 2, Second Gradeline 2 & 3, etc)
- b) Measured Line Uses two measured temporary points which will not be saved in a *Control Job* and optionally an entered grade
- c) Arc Uses three design points from the *Control Job* to define an arc

Stakeout Gradeline Procedure

1. Tap or select **Stakeout Gradeline** on the start menu screen
2. Select the method to *Define Gradeline By*
3. Stakeout Gradeline by Line

Stakeout Gradeline - Control Job				Stakeout Grade - Point Selection				Stakeout Gradeline						
Define Gradeline By: Line				Start Point of Gradeline: 1				Auto Stake Interval: 1.000						
Control Job: refset_test				End Point of Gradeline: 2				Auto Height Offset: 1.500						
				Enter Gradeline Grade: Yes				At End of Gradeline: Continue						
				Grade 1 in: 50.000				Gradeline Reference: 1 - 2						
								Hz Line from Start Pt: 0.075						
								Offset from Gradeline: -0.079						
								Height from Gradeline: 1.598						
OK	Config	Create New Job		OK	Config	Gradeline Info	Enter New Point	Measure New Point	Map	Dist	Start Auto	Previous Gradeline	Next Gradeline	New Gradeline

- 3.1. Select the *Control Job* to use from the list and press **F1** (OK)
- 3.2. Select the *Start Point* and *End Point* of the grade line to be staked out from the lists
- 3.3. Select **Yes** or **No** to *Enter Gradeline Grade* and if **Yes** enter the grade of the grade line (the grade line will then start at the elevation of the start point and go towards the end point at the entered grade) and press **F1** (OK)

3. Stakeout Gradeline by Measured Line

Stakeout Gradeline - Control Job				Measure Start Point of Gradeline				Stakeout Gradeline				
Define Gradeline By: Measured Line				New Point ID: Meas1				Auto Stake Interval: 1.000				
				Horiz Angle: 59° 12' 00"				Auto Height Offset: 0.000				
				Vert Angle: 85° 19' 12"				Gradeline Reference:				
				Slope Distance: 3.034				Hz Line from Start Pt: 0.907				
				Northing: 101.549				Offset from Gradeline: 0.128				
				Easting: 102.598				Height from Gradeline: -0.163				
				Elevation: 100.248								
OK	Config			Meas	Dist	OK		Dist	Start Auto			New Gradeline

- 3.1. Press **F1** (OK)
- 3.2. Point the TPS at the start point of the grade line (eg: at a point on an existing grade paintline) and press **F1** (Meas)
- 3.3. Point the TPS at the end point of the grade line (eg: at a point near the drive face) and press **F1** (Meas)
- 3.4. Select **Yes** or **No** to *Enter Gradeline Grade* and if **Yes** enter the grade of the grade line (the grade line will then start at the elevation of the start point and go towards the end point at the entered grade) and press **F1** (OK)

3. Stakeout Gradeline by Arc

Stakeout Gradeline - Control Job	Stakeout Grade - Point Selection	Stakeout Gradeline
Define Gradeline By: Arc	Start Point of Gradeline: 1	Auto Stake Interval: 1.000
Control Job: refset_test	Mid Point of Gradeline: 2	Auto Height Offset: 1.500
	End Point of Gradeline: 3	Gradeline Reference: 1 - 2 - 3
	Enter Gradeline Grade: No	H _z Arc from Start Pt: 0.079
		Offset from Gradeline: -0.074
		Height from Gradeline: 1.595

OK	Config	Create New Job	OK	Config	Gradeline Info	Enter New Point	Measure New Point	Map	Dist	Start Auto	New Gradeline
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- 3.1. Select the *Control Job* to use from the list and press **F1** (OK)
- 3.2. Select the *Start Point*, *Mid Point* and *End Point* of the grade line to be staked out from the lists
- 3.3. Select **Yes** or **No** to *Enter Gradeline Grade* and if **Yes** enter the grade of the grade line (the grade line will then start at the elevation of the start point and go on an arc through the midpoint towards the end point at the entered grade) and press **F1** (OK)

All Stakeout Gradeline Methods

4. Check the *Auto Stake Interval* value – this is the distance between the points staked in auto stakeout mode
5. Check the *Auto Height Offset* value – this is the *Height* offset that will be staked in auto stakeout mode
6. Check the *At End of Gradeline* setting – this defines the behaviour of the program when the end of the current grade line is reached in auto stakeout mode

Continue	The auto stakeout will continue on the same line past the end of the current grade line
Stop	The auto stakeout will stop at the end of the current grade line
Next Gradeline	The auto stakeout will increment to the next grade line at the end of the current grade line (eg: First Gradeline: 1 & 2, Next Gradeline 2 & 3, etc)
7. Point the TPS towards the wall at a position near where you want to start the stakeout
8. Press **F3** (Start Auto) to start the auto stakeout

Stakeout Gradeline Configuration

- *Start Dist Measure* Set to **Yes** to start distance measuring when the function starts
- *Auto Height Accuracy* Sets the accuracy at which the *Height* value is staked out in auto stakeout mode
(eg: if set to 0.025 the TPS will stake the grade line *Height* value to within $\pm 25\text{mm}$ of the *Auto Height Offset* value before moving to the next interval on the grade line)
- *Auto Interval Accuracy* Sets the accuracy at which the distance *Interval* between the points is staked out in auto stakeout mode
(eg: if set to 0.200 the TPS will stake the points on the grade line to within $\pm 200\text{mm}$ of the *Interval* setting from the previous point before moving to the next interval)
- *Auto Wait Time (secs)* Sets the time the TPS will stop on an auto stakeout point when it has been successfully staked out
(eg: if set to 5 the TPS will wait 5 seconds after it stakes out a point before it moves on to the next point)
- *Maximum Auto Search Time (secs)*
Sets the maximum time the TPS will search for an auto stakeout point. If set to zero the search time is infinite
(eg: if set to 30 the TPS will search for 30 seconds and if the point is not found it moves on to the next point)

6. Stakeout Laser

Stakeout Laser Procedure

Stakeout Laser - Job Selection				Stakeout Laser - Point Selection				Stakeout Laser - Point Selection			
Control Job: refset_test				Start Point of Design: 6				End Point of Design: 14			
				Enter Laser Grade: No							
OK Config Create New Job				OK Config Laser Info Enter New Point Measure New Point Map				OK Config			

1. Tap or select **Stakeout Laser** on the start menu screen
2. Select the *Control Job* to use from the list and press **F1** (OK)
3. Select the *Start Point* and *End Point* of the laser design reference line to be staked out from the lists or press **F6** (Map) and select the points there
4. Select **Yes** or **No** to *Enter Laser Grade* and if **Yes** enter the grade of the laser (the laser design reference line will then start at the elevation of the start point and go towards the end point at the entered grade) and press **F1** (OK)

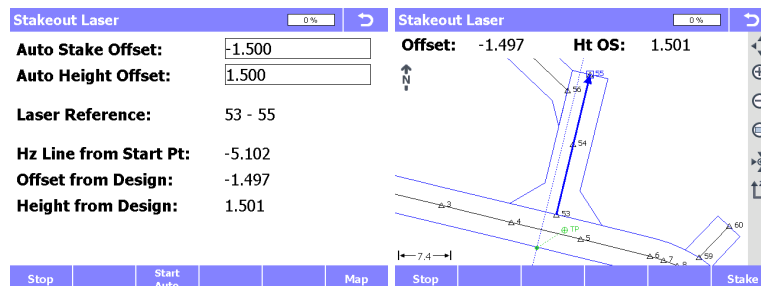
5. Stakeout Laser on Curve

Stakeout Laser				Stakeout Laser				Stakeout Laser			
Auto Stake Offset: -----				Offset: 0.528 Ht OS: 1.499				Auto Stake Offset: 0.528			
Auto Height Offset: 1.500								Auto Height Offset: 1.499			
Laser Reference: 6 - 14								Laser Reference: 7 - 15			
Hz Line from Start Pt: -----								Hz Line from Start Pt: -5.751			
Offset from Design: -----								Offset from Design: 0.528			
Height from Design: -----								Height from Design: 1.499			
Meas Laser Dist Start Auto Map				Dist Stake				Meas Laser Dist Start Auto Map			

- 5.1. In the Stakeout Laser screen - press **F6** (Map) to go to the map view and then window in the map to the relevant area
- 5.2. Point the TPS towards the drive wall at a good position for the laser and Press **F2** (Dist) to start measuring - the measured position will then be shown on the map view with a blue dashed line showing the offset line from the laser design reference line
- 5.3. While measuring, turn the TPS and/or reselect the laser design reference line *Start* and *End Points* (by tapping on or near a point symbol) to adjust the dashed offset line to the best position for the laser - including using the displayed *Ht OS* value to position the laser vertically
- 5.4. When the best laser position has been found, mark the position on the drive wall and then press **F6** (Stake) to go back to the laser stake view
- 5.5. With the TPS still pointing towards the laser position, press **F1** (Meas Laser) - the TPS will then measure the laser position and set the *Auto Stake Offset* and *Auto Height Offset* values on the stake screen to the measured values

- 5.6. Point the TPS towards the drive face near to the laser target position and press **F3** (Start Auto) to start the auto stakeout of the laser target position

5. Stakeout Laser on Straight



- 5.7. In the *Stakeout Laser* screen - enter the *Auto Stake Offset* value and check the *Auto Height Offset* value - these are the values that will be staked out in the auto stakeout mode
- 5.8. Point the TPS towards the drive wall near to the laser position and press **F3** (Start Auto) to start the auto stakeout of the laser position
- 5.9. When the laser position has been established and marked point the TPS towards the drive face near to the laser target position and press **F3** (Start Auto) to start the auto stakeout of the laser target position

Stakeout Laser Configuration

- *Start Dist Measure* Set to **Yes** to start distance measuring when the function starts
- *Auto Position Accuracy* Sets the accuracy at which the *Offset* and *Height Offset* values are staked out in auto stakeout mode
(eg: if set to 0.005 the TPS will stake the laser point *Offset* and *Height Offset* values to within $\pm 5\text{mm}$)
- *Default Auto Height OS* The *Auto Height Offset* value that is used for the auto stakeout will be reset to this value when the function starts

7. Stakeout Points

Stakeout Points Procedure

Stakeout Points - Control Job		Stakeout Points - Point Selection		Stakeout Points	
Control Job:	refset_test	Point to Stakeout:	1	Point ID:	1
		Northing:	101.634	^Hz to Point:	-1° 10' 57"
		Easting:	95.205	^Length to Point:	0.030 Away
		Elevation:	98.400	^Cross to Point:	-0.105 Left
				^Height to Point:	-1.600 Cut

OK	Config	Create New Job	OK	Config	Enter New Point	Measure New Point	Map	Dist	Start Auto	Previous Point	Next Point	New Point
----	--------	----------------	----	--------	-----------------	-------------------	-----	------	------------	----------------	------------	-----------

1. Tap or select **Stakeout Points** on the start menu screen
2. Select the *Control Job* to use from the list and press **F1** (OK)
3. Select the *Point to Stakeout* from the list and press **F1** (OK)
4. Point the TPS towards the backs near to the first point to be staked
5. Press **F3** (Start Auto) to start the auto stakeout

Missed Points Procedure

If any points are missed during the auto stakeout due to the *Maximum Auto Search Time* being exceeded then when the auto stakeout is stopped or finished a message will be shown asking to stake the missed points manually

1. Tap or select **Yes** or **No** to stake the points manually
2. If **Yes** the first missed point will be loaded and the point can then be staked by manually pointing the telescope
3. Press **F5** (Next Point) or **F4** (Previous Point) to cycle through the missed points
4. Press **F6** (New Point) to finish the missed point stakeout and resume normal operation

Stakeout Points Configuration

- *Turn to Point at Start* Set to turn the TPS towards the stakeout point when the function starts:
 - Yes – 2D** Turns the horizontal axis only
 - Yes – 3D** Turns both the horizontal and vertical axis
 - No** Does not turn the TPS

- *Start Dist Measure* Set to **Yes** to start distance measuring when the function starts

- *Auto Position Accuracy* Sets the accuracy at which the *Length* and *Cross* offset values are staked out in auto stakeout mode
 (eg: if set to 0.025 the TPS will stake the points *Length* and *Cross* values to within $\pm 25\text{mm}$ before moving to the next point)

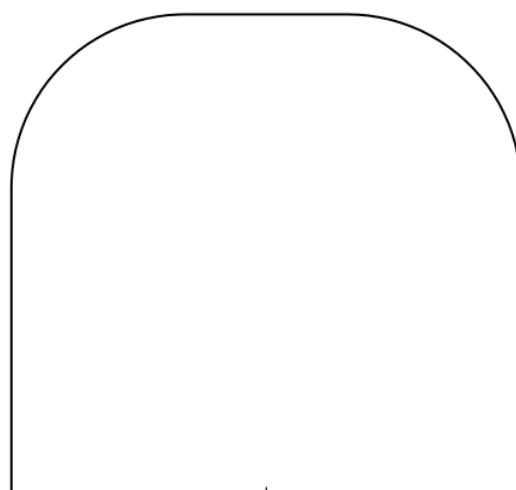
- *Auto Wait Time (secs)* Sets the time the TPS will stop on an auto stakeout point when it has been successfully staked out
 (eg: if set to 5 the TPS will wait 5 seconds after it stakes out a point before it moves on to the next point)

- *Maximum Auto Search Time (secs)*
 Sets the maximum time the TPS will search for an auto stakeout point. If set to zero the search time is infinite
 (eg: if set to 30 the TPS will search for 30 seconds and if the point is not found it moves on to the next point)

8. Stakeout Profile

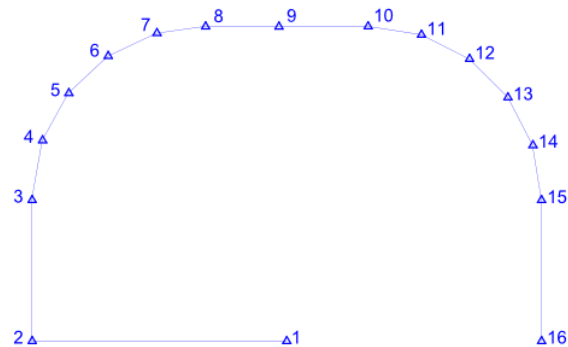
Profile Job Data Files

The *Profile Job* data files used in RefSet need to be setup in plan view coordinates (ie: Easting=Drive Width and Northing=Drive Height) with the coordinate origin (0E,0N) located at the centreline point of the profile. Note: The centreline does not need to be located on the profile outline (eg: it may be at the centre point of the profile).



Origin (0N,0E)
= Centreline

Profile File



Origin (0N,0E)
= Centreline

Stakeout Point File

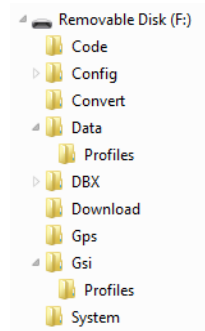
Each *Profile Job* needs two data files:

- a) Profile File Contains the full (detailed) profile outline string. The profile outline string needs to be a closed string in a clockwise direction. The point numbering is not important (eg: the point id's of the string may be blank). This outline is used to calculate the *Profile Offset* which is the shortest distance between a measured point and the profile and can be used to check for overbreak and underbreak.
- b) Stakeout Point File Contains the points that are to be staked out on the face in the auto stakeout mode. These points need to have individual point id's in consecutive order. Note: These points do not need to be located on the profile outline (eg: there can be a point on the centreline at gradeline height - Pt 1 in the above diagram).

The *Profile Job* data files need to be in the same format that is set in the *Data File Type* in the RefSet Program Configuration (ie: str, gsi or dxf). These files need to be located in a subfolder of the data files folder called *Profiles*. (ie: for str and dxf files the files need to be located in the *Profiles* folder under the *Data* folder and for gsi files in the *Profiles* folder under the *GSI* folder)

Profile Job Data Files Setup Procedure

1. Create a *Profiles* folder on the memory card under the data folder for the *Data File Type* set in RefSet (ie: for str and dxf files under the *Data* folder and for gsi files under the *GSI* folder)
2. Create a profile outline string ([see diagram above](#)) and **ensure the profile outline string is a closed string in a clockwise direction**
3. Use this string to create the Profile File in the same *Data File Type* set in RefSet and **ensure that this file contains only the outline string**
4. **The Profile File needs to be named with a ‘_profile’ suffix** (eg: 5x5_profile.gsi)
5. Create the profile stakeout points to be staked out on the face ([see diagram above](#)) and **ensure these points have individual point id’s in consecutive order**
6. Use these points to create the Profile Stakeout Point File in the same *Data File Type* set in RefSet
7. **The Stakeout Point File needs to be named with the same name as the Profile File but with a ‘_stake’ suffix** (eg: 5x5_stake.gsi)
8. Copy both the Profile File and the Stakeout Point File to the *Profiles* folder on the memory card (Note: These two files will represent one *Profile Job* in RefSet)



Stakeout Profile Procedure

1. Tap or select **Stakeout Profile** on the start menu screen
2. Select the method to *Define Centreline By*
3. Select the *Control Job* to use from the list
4. Select the *Profile Job* to use from the list and press **F1** (OK)
5. Stakeout Profile Centreline by Line

Stakeout Profile - Job Selection				Stakeout Profile - Point Selection				Stakeout Profile						
Define Centreline By: <input type="text" value="Line"/>				Start Point of Centreline: <input type="text" value="1"/>				Centreline Reference: 1 - 2						
Control Job: <input type="text" value="refset_test"/>				End Point of Centreline: <input type="text" value="2"/>				Slope Line from Start Pt: 12.232						
Profile Job: <input type="text" value="test_profile"/>				Profile Stakeout Point: <input type="text" value="1"/>				Offset from Centreline: -0.237						
								Perp Ht from Centreline: 1.369						
								Profile Stakeout Point: 1						
								Offset from Stake Pt: -0.237						
								Perp Ht from Stake Pt: -0.131						
								Offset from Profile: -1.369						
OK	Config	Create New Job		OK	Config	Centreline Info	Enter New Point	Measure New Point	Map	Dist	Start Auto	Previous Stake Pt	Next Stake Pt	New Stake Pt

- 5.1. Select the *Start Point* and *End Point* of the centreline of the profile to be staked out from the lists
- 5.2. Select the *Profile Stakeout Point* to be staked out from the list and press **F1** (OK)

5. Stakeout Profile Centreline by Arc

Stakeout Profile - Job Selection		Stakeout Profile - Point Selection		Stakeout Profile	
Define Centreline By:	Arc	Start Point of Centreline:	1	Centreline Reference:	1 - 2 - 3
Control Job:	refset_test	Mid Point of Centreline:	2	Slope Arc from Start Pt:	11.781
Profile Job:	test_profile	End Point of Centreline:	3	Offset from Centreline:	-2.043
		Profile Stakeout Point:	1	Perp Ht from Centreline:	1.647
				Profile Stakeout Point:	2
				Offset from Stake Pt:	0.307
				Perp Ht from Stake Pt:	0.147
				Offset from Profile:	-0.307

OK	Config	Create New Job	OK	Config	Centreline Info	Enter New Point	Measure New Point	Map	Dist	Start Auto	Previous Stake Pt	Next Stake Pt	New Stake Pt
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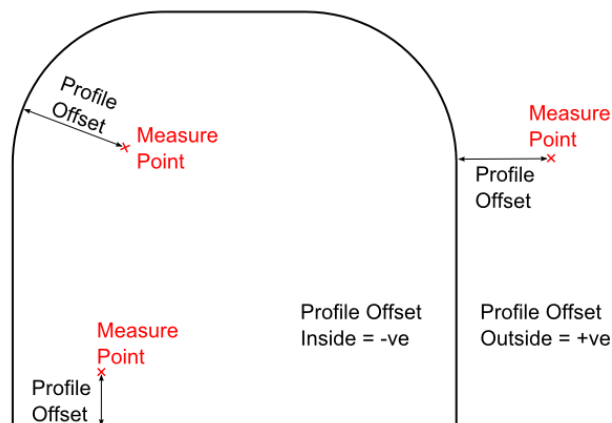
- 5.1. Select the *Start Point*, *Mid Point* and *End Point* of the centreline of the profile to be staked out from the lists
- 5.2. Select the *Profile Stakeout Point* of the profile to be staked out from the list and press **F1** (OK)

Both Stakeout Profile Methods

6. Point the TPS towards the drive face near to the first point to be staked
7. Press **F3** (Start Auto) to start the auto stakeout

Check Profile Procedure

1. Tap or select **Stakeout Profile** on the start menu screen
2. Setup the Profile Centreline and *Profile Job* as per points 1-5 in the [Stakeout Profile Procedure](#) above.
3. Point the TPS towards the point to be checked and Press **F2** (Dist) to start measuring
4. The *Offset from Profile* value can be used to check for overbreak and underbreak of the drive. Overbreak will have a positive *Offset from Profile* while underbreak will be negative (Note: ensure the profile outline string in the Profile File is a closed string in a clockwise direction otherwise this convention will be the opposite)



Stakeout Profile Configuration

- *Start Dist Measure* Set to **Yes** to start distance measuring when the function starts
- *Auto Position Accuracy* Sets the accuracy at which the stakeout point *Offset* and *Perp Height* values are staked out in auto stakeout mode
 (eg: if set to 0.025 the TPS will stake the profile stakeout point *Offset* and *Perp Height* values to within $\pm 25\text{mm}$ before moving to the next stakeout point)
- *Auto Wait Time (secs)* Sets the time the TPS will stop on an auto stakeout point when it has been successfully staked out
 (eg: if set to 5 the TPS will wait 5 seconds after it stakes out a point before it moves on to the next point)
- *Maximum Auto Search Time (secs)*
 Sets the maximum time the TPS will search for an auto stakeout point. If set to zero the search time is infinite
 (eg: if set to 30 the TPS will search for 30 seconds and if the point is not found it moves on to the next point)
- *Auto Search Limit (m)* Sets the distance limit for the point search in the auto stakeout mode. The auto stakeout will be restricted to within this distance from the start point of the auto stakeout

9. Survey

Survey Procedure

Survey - Job Selection		Survey: 130116.str		Survey: 130116.str									
Working Job: 130116		Point ID: 1											
		Code: 1											
		Target Height: 0.000											
		Horiz Angle: 339° 59' 59"											
		Vert Angle: 80° 00' 03"											
		Slope Distance: -----											
		Northing: -----											
		Easting: -----											
		Elevation: -----											
OK	Config	Create New Job		Meas	Dist	Store	Offsets	Map	Meas	Dist	Store	Offsets	Survey

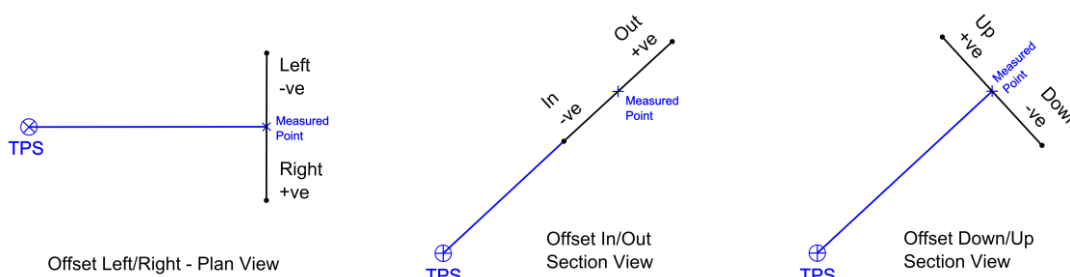
1. Tap or select **Survey** on the start menu screen
2. Select the *Working Job* to use from the list or press **F3** (Create New Job) to create a new working job file
3. Press **F1** (OK)
4. Press **F1** (Meas) to measure and store the point using the **Reflectorless Standard** EDM mode - this method can be used where more accuracy is needed
5. Press **F2** (Dist) to start measuring using the **Reflectorless Continuous** EDM mode and then press **F3** (Store) to store the measured point - this method can be used where more speed is needed

Note: When **F3** (Store) is pressed the TPS will not store the point until it has measured two shots that are within 50mm - this ensures that the stored point coordinates are not affected by any large TPS movements during measurement

Measured Point Offsets

1. Press **F5** (Offsets) to enter and apply offsets to the measured points
2. Select the *Offset Mode* to use. Select **Reset After Store** to apply the offsets to a single measured point or select **Permanent** to apply the offsets to all following measured points
6. Enter the offsets to use for the following measured point/s and then press **F1** (OK)

Survey - Enter Offsets	
Offset Mode:	Reset After Store
Offset Left/Right:	0.000
Offset In/Out:	0.000
Offset Down/Up:	0.000
OK	Zero Offsets



Survey Configuration

- Flash EGL on Pt Stored** When set to **Yes** the guide light will flash briefly when the point has been stored as a visual indicator
- Save Raw Data DAT File** Set to **Yes** to save the raw survey data (Hz Angle, Vt Angle, Slope Dist, etc) to a DAT file. The raw data will be saved to a file with the same name as the *Working Job* with a *.dat* extension which will be saved in the same folder as the *Working Job* file

Survey Screen Configuration

Survey - 130116.str		Survey - Screen Configuration	
Point ID:	1	1st Line:	Point ID
Code:	1	2nd Line:	Code
Target Height:	0.000	3rd Line:	Target Height
Horiz Angle:	237°31'49"	4th Line:	Horiz Angle
Vert Angle:	89°30'36"	5th Line:	Vert Angle
Slope Distance:	----	6th Line:	Slope Distance
Northing:	----	7th Line:	Northing
Easting:	----	8th Line:	Easting
Elevation:	----	9th Line:	Elevation
Screen Config	Quit	OK	

- In the Survey screen
- Press **Fn** then **F2** (Screen Config)
- Adjust the display settings to define the parameters shown on each line of the Survey screen

10. Survey Rig/Holes

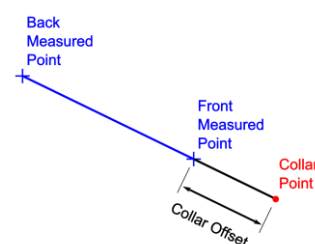
The *Survey Rig/Holes* function can be used to either check the alignment (azimuth and dip) of a drill rig setup (raise bore, blasthole rig, diamond drill rig, etc) or to survey completed drill holes and produce a drill hole survey report with the collar coordinates, azimuth and dip for each hole recorded.

Survey Holes Procedure

Survey Rig/Holes - Job Selection		Survey Rig/Holes - Hole Details		Survey Rig/Holes - Hole Info	
Working Job:	130320	Survey Type:	Rod (2 Points)	Hole ID:	HOLE1
Compare to Design Hole:	No	Hole ID:	HOLE1	Measured Azimuth:	112° 22' 22"
		Collar Offset:	0.150	Measured Dip:	-45° 42' 16"
				Collar Northing:	144.991
				Collar Easting:	123.240
				Collar Elevation:	100.600

OK	Config	Create New Job	OK	Config	OK
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1. Tap or select **Survey Rig/Holes** on the start menu screen
2. Select the *Working Job* to use from the list or press **F3** (Create New Job) to create a new working job file
3. Select **No** to *Compare to Design Hole* and press **F1** (OK)
4. Select the *Survey Type* of the survey. Select **Rod (2 Points)** to measure 2 points on a drill rod to calculate the azimuth and dip of the hole as well as the collar position of the hole or select **Collar (1 Point)** to measure just the collar position
5. Enter the *Hole ID* of the hole being surveyed
6. If using the **Rod Survey Type** enter the *Collar Offset* which is the slope distance from the front measured point on the rod to the collar position in line with the back measured point
7. If using the **Rod Survey Type** point the TPS towards the front point on the rod and press **F1** (Meas), then point the TPS towards the back point on the rod and press **F1** (Meas)
8. If using the **Collar Survey Type** point the TPS towards the collar point of the hole and press **F1** (Meas)
9. The measured hole information will then be displayed and will also be written to the survey drill hole report file which is saved in the same folder and has the same filename as the *Working Job* with either a '.csv' or '.txt' extension depending on the *DH Report File Type* set in the Survey Rig/Holes Configuration
10. Press **F1** (OK) to survey the next drill hole



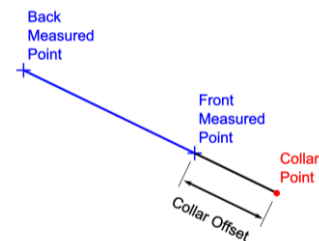
Rod Survey - Section View

Check Drill Rig Procedure

Survey Rig/Holes - Job Selection		Survey Rig/Holes - Design Hole		Survey Rig/Holes - Hole Details	
Working Job:	130320	Design Hole Collar:	1	Survey Type:	Rod (2 Points)
Compare to Design Hole:	Yes	Design Hole Toe:	2	Hole ID:	1
Control Job:	holestest			Collar Offset:	0.000

OK	Config	Create New Job	OK	Config	Design Hole Info	Enter New Point	Map	OK	Config
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1. Tap or select **Survey Rig/Holes** on the start menu screen
2. Select the *Working Job* to use from the list or press **F3** (Create New Job) to create a new working job file
3. Select **Yes** or **No** to *Compare to Design Hole* and then if **Yes** select the *Control Job* to use from the list and press **F1** (OK)
4. If comparing to a design hole select the *Design Hole Collar* and *Design Hole Toe* points from the lists and press **F1** (OK)
5. Select **Rod (2 Points)** for the *Survey Type*
6. Enter the *Hole ID* of the drill rig survey - this is not really relevant for a drill rig check so can be set to a dummy number (eg: 1)
7. Enter the *Collar Offset* of the drill rig survey which is the slope distance from the front measured point on the rig or rod to the collar position in line with the back measured point
8. Point the TPS towards the front or bottom point on the rig or rod and press **F1** (Meas), then point the TPS towards the back or top point on the rig or rod and press **F1** (Meas)
9. The drill rig check information will then be displayed and will also be written to the survey drill hole report file which is saved in the same folder and has the same filename as the *Working Job* with either a '.csv' or '.txt' extension depending on the *DH Report File Type* set in the Survey Rig/Holes Configuration



Rod Survey - Section View

Note: If comparing to a design hole the drill rig check information includes the *Projected Toe* coordinates. These coordinates are calculated using the measured dip and azi and projecting the hole from the collar position for the same length as the design hole

10. Press **F1** (OK) to resurvey the drill rig check

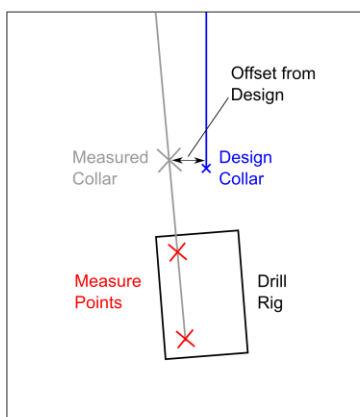
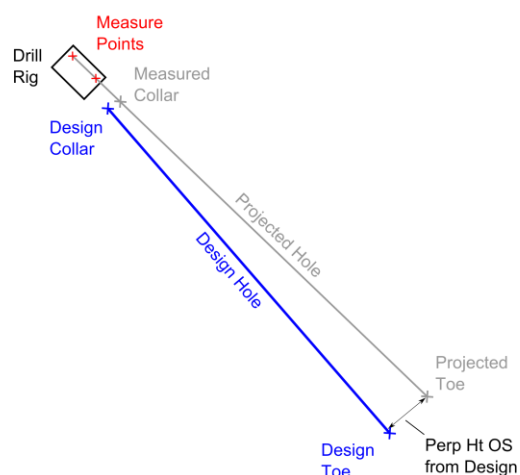
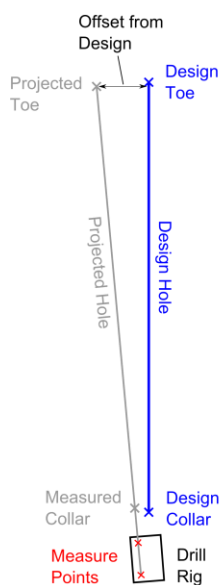
Check Drill Rig Info

Survey Rig/Holes - Hole Info			Survey Rig/Holes - Hole Info			Survey Rig/Holes - Hole Info		
Hole ID:	1		Hole ID:	1		Hole ID:	1	
Measured Azimuth:	180° 14' 59"		Collar Northing:	95.507		Projected Toe Northing:	67.477	
Design Azimuth:	179° 25' 58"		Collar Easting:	102.782		Projected Toe Easting:	102.660	
Azimuth Difference:	0° 49' 01"		Collar Elevation:	100.178		Projected Toe Elevation:	110.871	
Measured Dip:	20° 52' 49"		Offset from Design:	-0.625		Offset from Design:	-0.225	
Design Dip:	20° 00' 25"		Perp Ht OS from Design:	0.008		Perp Ht OS from Design:	0.466	
Dip Difference:	0° 52' 24"							
OK		Page	OK		Page	OK		Page

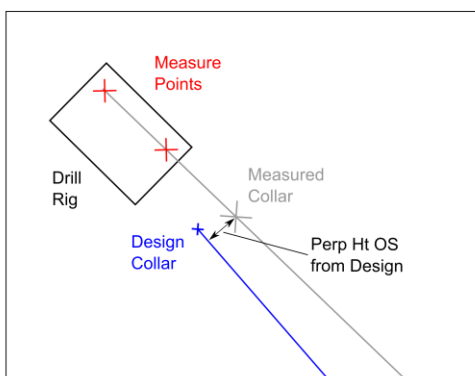
Angle Info

Collar Info

Projected Toe Info



Plan View



Section View

Survey Rig/Holes Configuration

- *DH Report File Type* Set to the type of drill hole report file to save the drill hole information to. This file will be saved in the same folder and have the same filename as the *Working Job*:

CSV	Comma separated text file
TXT	Space separated text file

- *DH Report Angle Format* Set to the angle format used for the azimuth and dip in the drill hole information display and the drill hole report file:

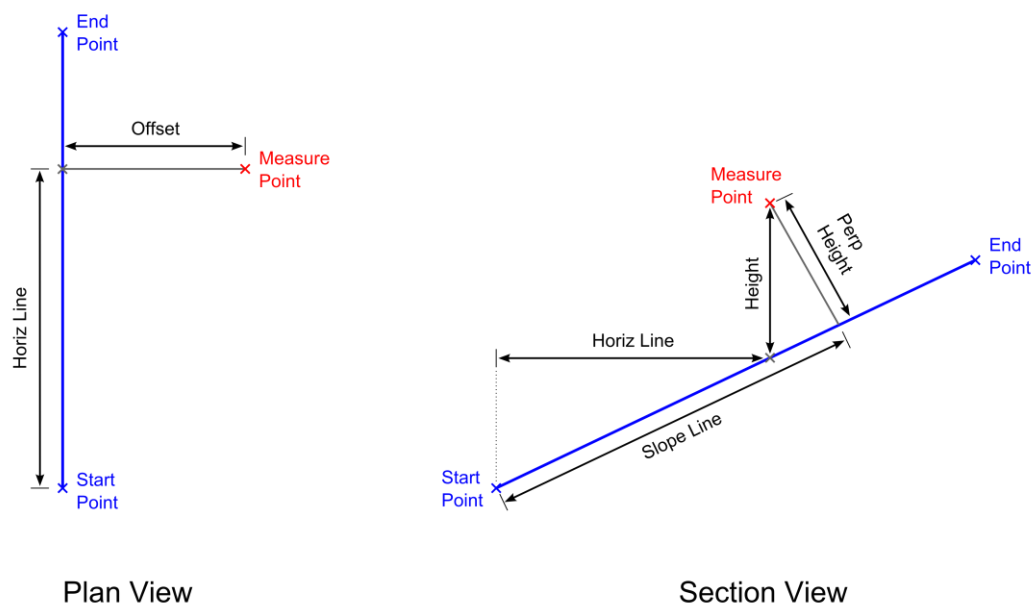
Deg Min Sec	Degrees, minutes, seconds
Decimal Deg	Decimal degrees

- *Save Raw Data DAT File* Set to **Yes** to save the raw survey data (Hz Angle, Vt Angle, Slope Dist, etc) to a DAT file. The raw data will be saved to a file with the same name as the *Working Job* with a *'.dat'* extension which will be saved in the same folder as the *Working Job* file

11. RefSet General

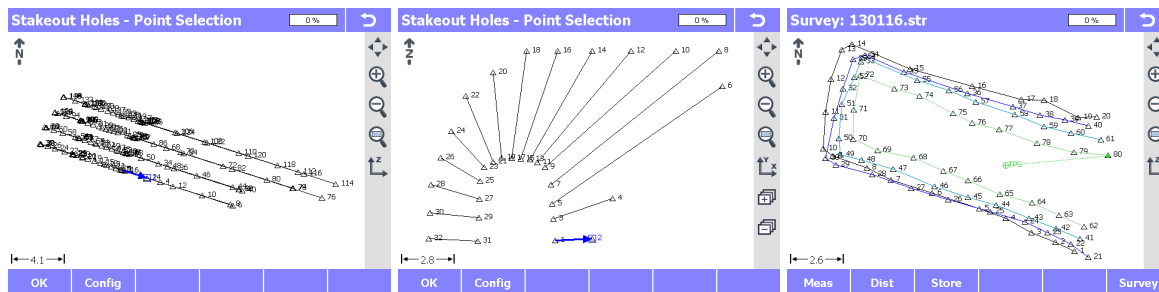
- Press **F5** (SmartWorx) in the main start menu to exit RefSet and start the Leica SmartWorx program
- Press **Fn, F6** (Quit) to return to the main start menu from any screen in the program
- The *Control Job* lists can be searched using the alpha keys (eg: press **3** once to jump to the control jobs starting with the letter D, twice to jump to E, etc)
- It is important to number the points in the control job in a logical consecutive order to enable RefSet to increment to the next feature in auto stakeout modes
- Always point the TPS towards the first feature to stakeout before starting any of the auto stakeout modes, RefSet basically uses a trial and error method to do the auto stakeout, so it helps if it is near the first feature when it starts
- In the **Measure New Point** function pressing **Meas** will measure the point in standard reflectorless mode, while pressing **Dist** will measure in reflectorless continuous mode

Reference Line Offsets Description



Map View

The Map View may be accessed from the point selection screens in the stakeout functions to display the control job and select the design point/s used in the functions or from the survey function to display the working job as points are surveyed.



Map Plan View

Map Section View

Survey Map View

Map View Menu Functions

Icon	Key	Description
	1	Zoom All – Fits all the map data to the screen
	2	Zoom In - Zoom in to the map a set amount
	3	Zoom Out - Zoom out of the map a set amount
		Zoom Window - The zoom window can be defined by either tapping and dragging to draw a rectangle or by tapping the two corners of the rectangle. The map will then zoom to the selected window
		Centre - Centre the map on the TPS position
		Section View - The section view can be defined by either tapping and dragging to draw a line or by tapping the two ends of the line. The map will then change to the section view. Note: Tapping on or near a point symbol will snap the section line to that point
		Plan View - Change the map back to the plan view
	6	Step Section Forward - Steps the section view forward by the step distance set in the map configuration
	4	Step Section Backward - Steps the section view backward by the step distance set in the map configuration
		Pan Map - Tap anywhere on the screen and drag to pan the map

Design Point / Line Selection



The design points used in the stakeout functions can be selected by tapping on or near a point symbol. The point will then be highlighted with a blue box



The design lines used in the stakeout functions can be selected by tapping on or near a point symbol and will alternate from the start point of the line to the end point of the line. The line will then be highlighted in blue with the line direction shown by an arrow

Map View Configuration

- *Section View Width* Sets the width of the section view. Only points and lines that are within this width around the section line will be visible in the map section view
- *Section View Step* Sets the step distance when stepping forward and backward in the map section view
- *Display Points* Set to **Yes** to display the points in the map view
- *Display Point IDs* Set to **Yes** to display the point IDs of the points in the map view
- *Display Lines* Set to **Yes** to display the lines in the map view